

GCSE

Mathematics

Linked Pair – Applications of Mathematics
Paper Unit 1 Higher tier
Mark Scheme

93701H
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Version/Stage 1.0 Final

Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
oe	Or equivalent. Accept answers that are equivalent. eg, accept 0.5 as well as $\frac{1}{2}$
[a, b]	Accept values between a and b inclusive.
3.14...	Allow answers which begin 3.14 eg 3.14, 3.142, 3.149.
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles

Diagrams

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

Responses which appear to come from incorrect methods

Whenever there is doubt as to whether a candidate has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the candidate. In cases where there is no doubt that the answer has come from incorrect working then the candidate should be penalised.

Questions which ask candidates to show working

Instructions on marking will be given but usually marks are not awarded to candidates who show no working.

Questions which do not ask candidates to show working

As a general principle, a correct response is awarded full marks.

Misread or miscopy

Candidates often copy values from a question incorrectly. If the examiner thinks that the candidate has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

Further work

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

Choice

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

Work not replaced

Erased or crossed out work that is still legible should be marked.

Work replaced

Erased or crossed out work that has been replaced is not awarded marks.

Premature approximation

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Q	Answer	Mark	Comments
1(a)	= Sum (C2 : C6) or = C2 + C3 + C4 + C5 + C6 or = Sum (C2 + C3 + C4 + C5 + C6) or = Sum (C2 , C3 , C4 , C5 , C6)	B2	B1 For formula without equals sign or B1 For one cell reference error eg = Sum(C1 : C6) or = (C2 + C3 + C5 + C6) Condone missing brackets
1(b)	Mean circled or indicated	B1	

2(a)	Line from 15 to 22	B1	± 1 mm
	Open circles on both ends	Q1	Strand (i) Correct mathematical notation

Q	Additional Guidance	Mark
2(a)	Allow use of given line with open circles at 15 and 22 for B2 Or two circles at 15 and 22 with 1 or 2 closed for B1	

2(b)	$22 < x \leq 25$ or $22 < x$ and $x \leq 25$	B2	B1 22 and 25 used but one incorrect symbol or B1 For $22 < x$ or $x \leq 25$ oe
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Q	Additional Guidance	Mark
2(b)	$22 \leq x \leq 25$ (one incorrect symbol)	B1
	$22 < x < 25$ (one incorrect symbol)	B1
	$22 > x > 25$ (two incorrect symbols)	B0

Q	Answer	Mark	Comments
3	Alternative method 1		
	180 ÷ 3 and 245 ÷ 4 (compares 150g) or 180 ÷ 9 and 245 ÷ 12 (compares 50g) or 180 ÷ 450 and 245 ÷ 600 (compares 1g)	M1	Oe Compares any number of grams consistently. Can be in pence or pounds
	60 and 61 or [61.2, 62.3] or 20 and 20(.4...) or 0.4(0) and [0.408, 0.41]	A1	Comparing same number of grams Can be in pence or pounds
	Regular	Q1ft	Strand (iii) ft Conclusion based on their 2 values if M1 awarded
	Alternative method 2		
	450 ÷ 180 and 600 ÷ 245 or 450 ÷ 1.8(0) and 600 ÷ 2.45	M1	Compares grams per penny or grams per pound
	2.5 and [2.4, 2.45] or 250 and [2.4, 2.45]	A1	
	Regular	Q1ft	Strand (iii) ft Conclusion based on their 2 values if M1 awarded

Q	Answer	Mark	Comments
3	Alternative method 3		
	$1.80 \div 3 \times 4$	M1	oe Can be in pence or pounds
	2.40	A1	Must be in pounds unless 245p also seen
	Regular	Q1ft	Strand (iii) ft Conclusion based on their 2 values if M1 awarded
	Alternative method 4		
	$2.45 \div 4 \times 3$	M1	oe Can be in pence or pounds
	1.83(...) or 1.84	A1	
	Regular	Q1ft	Strand (iii) ft Conclusion based on their 2 values if M1 awarded
	Alternative method 5		
	$450 \div 600$ and $1.80 \div 2.45$	M1	oe
	0.75 and 0.73(...)	A1	
	Regular	Q1ft	Strand (iii) ft Conclusion based on their 2 values if M1 awarded

Q	Additional Guidance
3	<p>Candidates can work in pounds or pence throughout providing that their final comparison is based on the same units</p> <p>If both of their answers are quoted to 1 sf or are the same (eg 0.4, 0.4) allow Q1 ft for regular.</p> <p>Eg $180 \div 450 = 0.4$</p> <p>$245 \div 600 = 0.4$</p> <p>Regular</p> <p>Award M1 A0 Q1 (Assume more d.p. on calculator)</p>

Q	Answer	Mark	Comments
4	$0.21n + 7.25 = 0.19n + 9.95$	B1	oe
	$0.02n = 2.7(0)$	M1	Simplifying their linear equation to $an = b$ provided term in n and constant on both sides.
	their $2.7(0) \div$ their 0.02	M1	Simplifying their linear equation to $n =$
	135	A1	SC3 For 1.35 from an algebraic approach (using $21n + 7.25 = 19n + 9.95$) SC2 For 135 from T&I/numerical approach

Q	Additional Guidance	Mark
4	The middle two method marks are for simplifying their linear equation Example $0.21n + 7.25 = 0.19n + 9.95$ $0.02n = 17.2$ $n = 17.2 \div 0.02$ $n = 860$	B1 M0 M1 A0
	T&I methods are only awarded marks for a correct answer	

5	Alternative method 1		
	$42.9 \div 1.1$ or 57×0.65	M1	
	39 or 37.05	A1	
	$42.9 \div 1.1$ and 57×0.65	M1	oe
	39 and 37.05 and Plane	A1	
	Alternative method 2		
	57×0.65	M1	
	37.05	A1	
	their 37.05×1.1	M1	Oe their 37.05 must be from an attempt at a percentage of 57

	40.75(5) or 40.76 or 40 or 41 and Plane	A1	
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Q	Answer	Mark	Comments
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6(a)	Correct polygon	B2	B1 For one error - incorrect horizontal point/incorrect height/ no straight lines
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Q	Additional Guidance
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6(a)	Ignore any lines before or after endpoints. Consistent incorrect horizontal position is one error.
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6(b)	Plant B as there are 10 values in the 10-12 group whereas for Plant A there is only one value	B1	Oe Allow 11cm group to indicate 10 – 12 group
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7(a)	$\frac{9}{30}$ or $\frac{3}{10}$ or 0.3 or 30%	B1	
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7(b)	$\frac{63}{100}$ or 0.63 or 63%	B1	
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7(c)	Jake because he has done more trials/more trials give a better estimate	B1	oe
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7(d)	185 or 177	B1ft	ft The correct relative frequency for their chosen person from (c) multiplied by 500 or 177 from $\frac{46}{130} \times 500$
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Q	Additional Guidance	Mark
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7(d)	If Ali is chosen in (c) then they should use $\frac{9}{30} \times 500 = 150$ Allow use of total of Ali and Jake 185 out of 500 $\frac{185}{500}$	B1ft B1 B0
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Q	Answer	Mark	Comments
8	Alternative method 1		
	3×8	M1	
	$500 \div (16 + 3 \times 8)$	M1	
	(Small sack =) 12.5 (kg)	A1	
	(Large sack =) 37.5 (kg)	B1ft	ft their small sack $\times 3$ SC3 Small = 200, large = 300
	Alternative method 2		
	$16 \div 3$ or $5 \frac{1}{3}$	M1	
	$500 \div (8 + 5 \frac{1}{3})$	M1	
	Large 37.5	A1	
	Small 12.5	B1 ft	ft their large sack $\div 3$ SC3 Small = 200, large = 300
	Alternative method 3		
	Any trial using two values that satisfy $16x$ and $24x$	M1	
	An improved trial using two values that satisfy $16x$ and $24x$	M1	Totals must be seen
	(Small sack =) 12.5 (kg)	A1	
	(Large sack =) 37.5 (kg)	B1ft	ft their small sack $\times 3$ SC3 Small = 200, large = 300

Q	Additional Guidance
8	<p>Alternative method 1</p> <p>24 seen does not imply M1 as it may have come from $8 + 16$</p> <p>$16 + 24$ implies the first M1</p> <p>$500 \div 40$ is M2</p> <p>Alternative method 3</p> <p>eg Trying $x = 4 \rightarrow 64 + 94 = 158\text{kg}$ gains M1</p> <p>then trying $x = 8 \rightarrow 128 + 192 = 320$ gains 2nd M1 (closer to total of 500)</p>

9(a)	[317,318]	B1	
9(b)	5.34×10^{24}	B2	B1 For 5.338×10^{24}

Q	Answer	Mark	Comments
10(a)	9	B1	
10(b)	Alternative method 1		
	Maths median = 33 and French median = 24	B2	B1 For one correct
	Alternative method 2		
	French median = 24 and More than half the students score higher than 24 in Maths so the median must be higher	B2	oe B1 For French median 24 with no explanation or incorrect explanation
10(c)	'only changes French' (2nd box) ticked or indicated	B1	

Q	Additional Guidance	Mark
10(c)	More than one box ticked	B0

10(d)	A set of 4 values fitting all criteria eg 36 40 42 42 33 41 41 41 30 41 41 44	B3	B2 A set of 4 values with mode 2 higher than the mean with median not 41. Eg 41, 43, 46, 46 B2 A set of 4 values with correct median but 2 modes or mode two lower than the mean eg 39 39 43 43 (median 41 and mean 41 is 2 above 39 but 2 below 43 because two modes) or 40 41 41 50 (median 41, mode 41, mean 43) B1 Any set of 4 values with a median of 41 and any mode eg 37 41 41 41 (median 41, mode 41, mean 40) 27 35 47 47 (median 41, mode 47, mean 39)
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Q	Answer	Mark	Comments
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Q	Additional Guidance	Mark
10(d)	<p>If 41 is the mode and appears twice then the two other numbers must total 74</p> <p>eg 32 41 41 42</p> <p>24 41 41 50</p> <p>Mark final answer. If answer line blank mark the final set of 4 numbers in the working.</p>	B3

11(a)	32	B1	
11(b)	39 or 24 seen	M1	
	15	A1	
11(c)	Median at 34	B1	$\pm\frac{1}{2}$ s s
	Box from 27 to 38	B1	$\pm\frac{1}{2}$ s s
	Whiskers 16 and 48	B1	$\pm\frac{1}{2}$ s s
11(d)	<p>Comparison using median value in context</p> <p>eg Mary cycles further on average, Mary cycle 2 miles more on average</p>	B1	ft their median in part (a)
	<p>Comparison using Inter-quartile range</p> <p>eg The distances Mary cycles are more consistent than John</p>	B1	ft their IQR in part (b)

Q	Answer	Mark	Comments
12	Alternative method 1		
	<p>Get the same number of bottles Shows method for any two shops eg getting 6 bottles Two of Shop A: pay 2 + 2 get 3 + 3 Shop B: pay 1.5 + 1.5 + 1.5 get 2 + 2 + 2 Shop C: pay 0.6 × 6</p>	M1	Comparing number of bottles paid for when actually getting the same number of bottles
	<p>Two correct values eg getting 6 bottles Two of Shop A: pay for 4 Shop B: pay for 4.5 Shop C: pay for 3.6</p>	A1	
	Shows method to compare equivalent number of bottles for the 3rd shop	M1	Third method from those above
	3rd correct answer and C is cheaper	A1	

Q	Answer	Mark	Comments
12	Alternative method 2		
	<p>Pay for the same number of bottles Shows method for any two shops eg paying for 6 bottles</p> <p>Two of</p> <p>Shop A: pay $2 + 2 + 2$ get $3 + 3 + 3$</p> <p>Shop B: pay $1.5 + 1.5 + 1.5 + 1.5$ get $2 + 2 + 2 + 2$</p> <p>Shop C: pay $6 \div 0.6$</p>	M1	Comparing number of bottles got when paying for the same number of bottles. Any multiple of 3 bottles can be used
	<p>Two correct values eg paying for 6 bottles</p> <p>Two of</p> <p>Shop A: get 9 Shop B: get 8 Shop C: get 10</p>	A1	
	Shows method to compare equivalent number of bottles for the 3rd shop	M1	Third method from those above
	3rd correct answer and C is cheaper	A1	

Q	Answer	Mark	Comments
12	Alternative method 3		
	Choose an amount per bottle Shows method for any two shops eg chooses £1 Two of Shop A: $2 \div 3$ Shop B: $1.50 \div 2$ Shop C: 1×0.6	M1	Comparing unit cost per bottle
	Two correct values eg chooses £1 Two of Shop A: 66p or 67p each Shop B: 75p each Shop C: 60p each	A1	
	Shows method to compare equivalent amount for the 3rd shop	M1	Third method from those above
	3rd correct answer and C is cheaper	A1	
12	Alternative method 4		
	Compares percentage discount (40% given for C) Shop A: $\frac{1}{3} \times 100$	M1	
	33(.3...)%	A1	
	Shop B: $\frac{0.5}{2} \times 100$	M1	
	25% and C is cheaper	A1	
Q	Additional Guidance		
12	For the multiplying up scheme students can look at buying a particular number of bottles and compare how many they pay for or Paying for a particular number of bottles and comparing how many bottles they actually get.		

Q	Answer	Mark	Comments
13	Alternative method 1		
	$2m + 3h = 9.3(0)$ or $5m + 2h = 10.6(0)$	B1	
	$4m + 6h = 18.6$ and $15m + 6h = 31.8$	M1	oe equating coefficients of h Allow one error in totals
	$11m = 13.2$	M1	Subtracting
	(Marmalade = £)1.20	A1	
	(Honey = £) 2.30	A1	
	$(1.2 + 4 \times 2.3) = 10.4$ and No	Q1ft	their $1.2 + 4 \times$ their 2.3 compared with £10 and conclusion made QWC strand (ii)
	Alternative method 2		
	$2m + 3h = 9.3(0)$ or $5m + 2h = 10.6(0)$	B1	
	$10m + 15h = 46.5$ and $10m + 4h = 21.2(0)$	M1	oe equating coefficients of m Allow one error in totals
	$11h = 25.3$	M1	subtracting
	(Honey =)2.30	A1	
	(Marmalade =) 1.20	A1	
	$(1.2 + 4 \times 2.3) = 10.4$ and No	Q1ft	their $1.2 + 4 \times$ their 2.3 compared with £10 and conclusion made QWC strand (ii)

Q	Additional Guidance
13	T & I method giving M = 1.20 and H= 2.30 is B1 M1 M1 A1 A1. No part marks. Q1 ft can be gained from incorrect T & I values.

14	$((1 + 2.75/(100 \times 12))^{12} - 1) \times 100$	M1	
	1.0278(49...) or 0.0278(49...) seen	M1	Implied by 2.78(%)
	2.78(%) and account 2	A1	

Q	Answer	Mark	Comments
15	$30 \times 65 \div 185$ or $30 \times 93 \div 185$ or $30 \times 27 \div 185$ or correct decimal 10.5(4...), or 15.0(8...), or 4.3(7...)	M1	Correct method seen for one item or one correct decimal seen
	11, 15, and 4	A2	A1 For 1 correct value
16(a)	$(60 - 30) \times 0.7$ or $(75 - 60) \times 1.8$	M1	
	21	A1	
	27	A1	
Q	Additional Guidance		
16(a)	One correct value with no working implies M1A1		
16(b)	0.8 or 0.3 seen	M1	
	Both bars correct height and width (90-120 at height 0.8 and 120-180 at height 0.3)	A1	One correct bar implies M1
16(c)	Alternative method 1		
	$18 \times (180 - 130)/60$	M1	oe
	15	A1	SC1 $18 \times 10/60 = 3$
	Alternative method 2		
	$(180 - 130) \times \text{their } 0.3$	M1	oe
	15	A1ft	ft or correct ft their freq density for 120 – 180 SC1 $10 \times \text{their } 0.3 = 3$

Q	Answer	Mark	Comments
17(a)	$6000x + 8000y \leq 84\,000$ or $6x + 8y \leq 84$	B1	
Q	Additional Guidance		
17(a)	Only allow the 2 alternatives given.		
17(b)	Correct area clearly indicated on the graph	B1	
Q	Additional Guidance		
17(b)	Accept area shaded in or shaded out		
17(c)	Trial of any integer point at or close to a vertex of the region	M1	Allow points on dotted line.
	10 small cars, 3 medium cars,	A1	
	272	A1	SC2 For 11 small, 2 medium and 268

Q	Answer	Mark	Comments
18	Alternative method 1		
	18.5 or 18.4 $\dot{9}$ or 12.5 or 12.4 $\dot{9}$	B1	
	45 or 44. $\dot{9}$	B1	
	their 18.5 \times their 12.5 or 231.25	M1	their upper bounds multiplied
	their 231.25 \times their 45 or 10 406.25	M1	Multiplying by their upper bound for fertiliser
	10.4(06.25) (kg) and No	A1	Allow 10 406(.25) if 10kg = 10 000g seen.
	Alternative method 2		
	18.5 or 18.4 $\dot{9}$ or 12.5 or 12.4 $\dot{9}$	B1	
	45 or 44. $\dot{9}$	B1	
	their 18.5 \times their 12.5 or 231.25	M1	their upper bounds multiplied
	10 000 \div their 45 or 222. $\dot{2}$	M1	Dividing by their upper bound for fertiliser or 10 000 \div their 231.25 or 43.243
	231(.25) and 222(.2...) and No	A1	43(.243..) and 45 and No

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